User Manual ZNet LHT v3

1st March 2009

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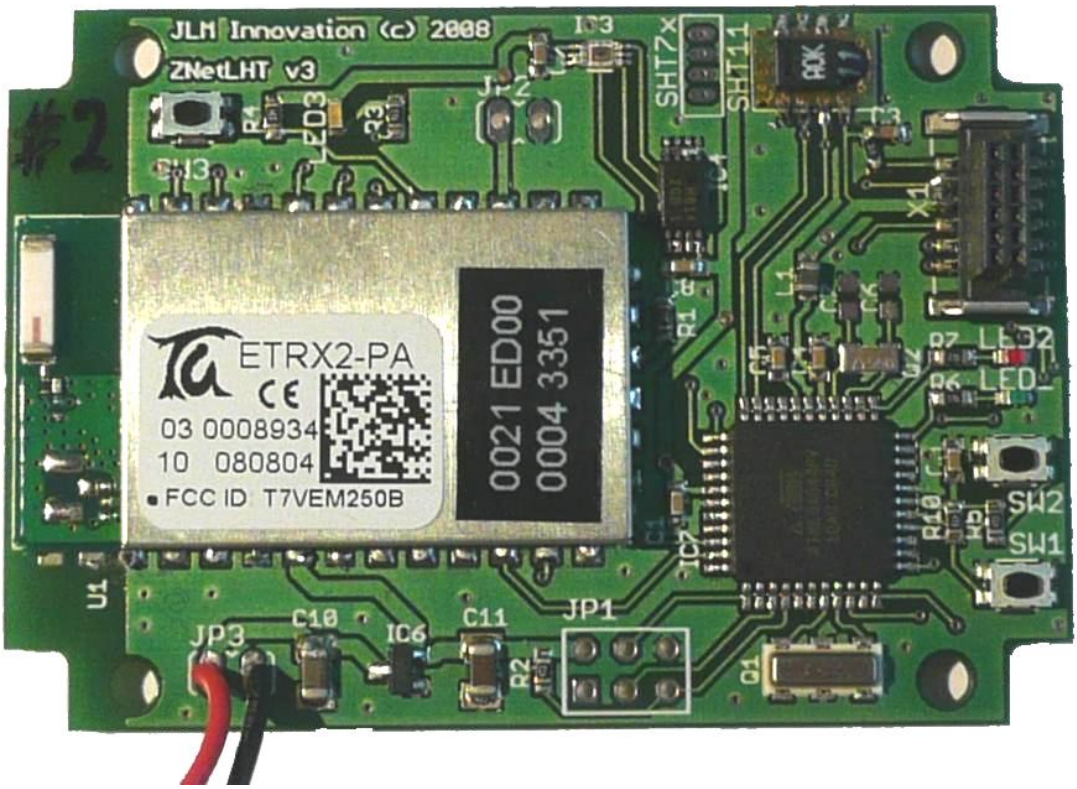

Introduction

ZNet is a wireless sensor network based on IEEE 802.15.4. It consists of sensor nodes that contain a wireless transceiver, a microcontroller and one or more sensors.

The sensor network is connected to a PC via a USB stick or an Ethernet access point. The network is controlled via software running on a PC under Microsoft Windows. The software is configuring the sensor network and records the measurement data.

ZNetLHT is the first type of sensor node available and contains light, temperature and humidity sensors. Additionally 2 analog inputs may be used to connect other sensors. Measurement data can be stored to internal non volatile memory of 128kB.

ZNet Telnet Server is software running under Windows XP / Vista. This software allows configuring the sensor network and recording of measurement data to a text file. It also operates as a telnet server, feeding measurement data to other software, which may run on the same computer, or another computer connected via Ethernet. This allows for the sensor network to be integrated with common software packages like LabView or Matlab.

The Sensor Nodes ZNetLHT

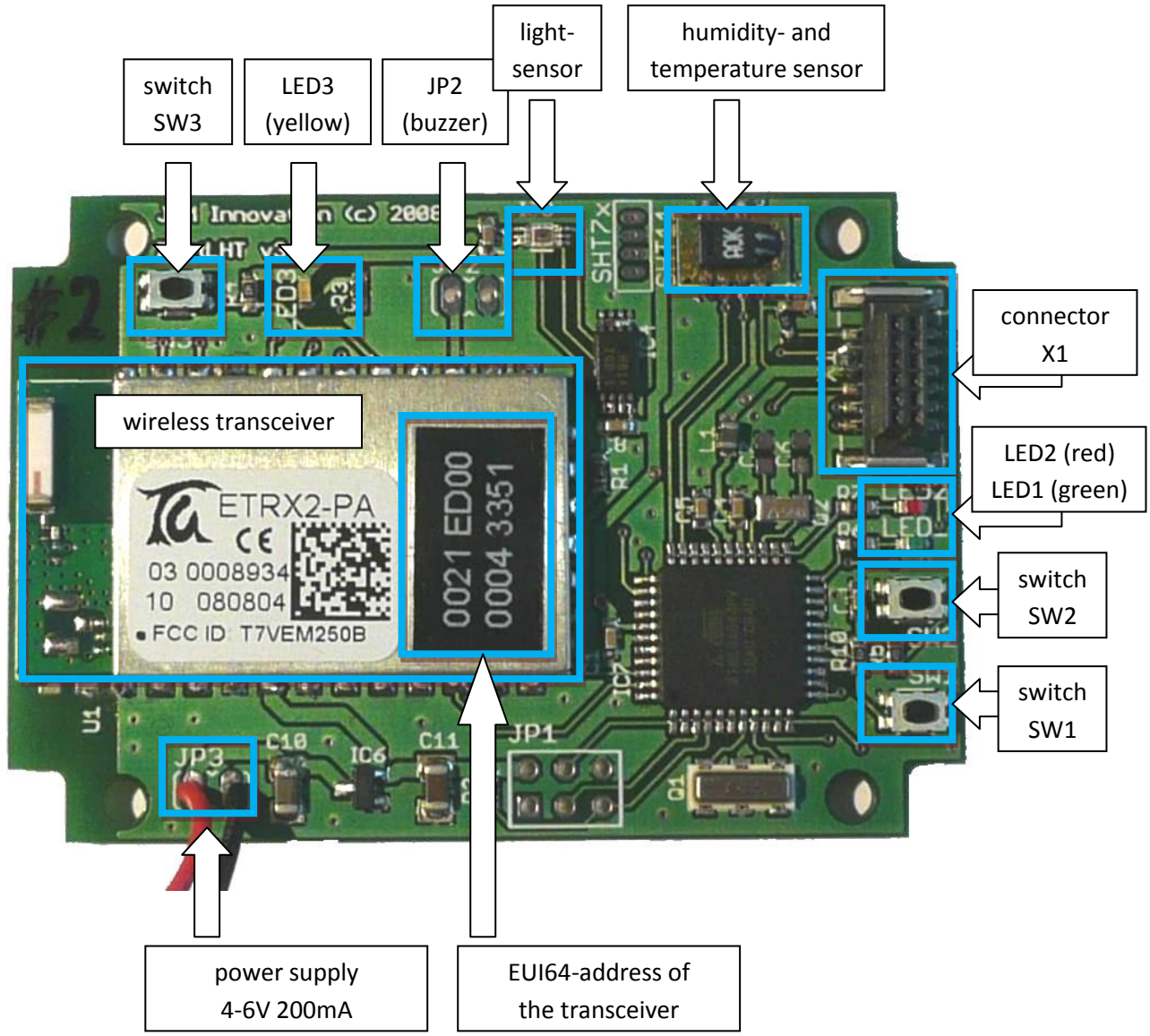

Figure 1: A Sensor node ZNetLHT

Figure 1 shows a sensor node ZNetLHT with connectors, sensors and controls.

The Transceiver

Standard ZNet nodes are using the Telegesis ETRX2 ZigBee modules with built in antenna, operating in the 2.4GHz ISM band. Optionally power amplified versions (identified by the suffix –PA) and modules with external antenna are available for long range applications.

Typical range for standard nodes is 10-20 (indoors) to 50-150 meters (open field) and will be affected by any obstacles in the transmission path as well as other senders operating in the same frequency range. Power amplified modules will increase the range by a factor of 2 to 4.

The Light Sensor

The light sensor is a Rohm BH1710VFC . This sensor is characterized by small size and low power consumption. It is connected via a digital I2C interface and measures light in the range of 1 -65536 lx.

The Temperature and Humidity Sensor

To measure temperature and humidity a SHT-11 from Sensirion is used. This sensor has a proprietary digital interface similar to I2C and measures temperatures in the range of -20 to 100°C and humidity in the range of 0 – 100% r.H. (optimum range: 20 – 80% r.H.).

Push Buttons und LEDs

There are 3 bush buttons SW1 to SW3 and 3 LEDs LED1 to LED3 onboard the node.

SW1 and SW2, as well as LED1 und LED2 are connected to the micro controller. Their function depends on the installed firmware. Please refer to the firmware operation manual for further details.

SW3 und LED3 are connected to the wireless transceiver. Pushing SW3 wakes up the wireless transceiver from power save mode. LED3 can be switched on and off from the server software in order to identify nodes or to test the communication between the PC and a node.

JP2 Buzzer

An optional piezo buzzer may be connected to JP2. A command issued from the server software will play a short melody on the buzzer, e.g. to identify or find a sensor node.

Power Supply

Power is typically supplied by three 1.5V batteries. The ZNet nodes are delivered with a battery holder for three AAA batteries. Alternatively other power supplies providing 4 bis 6 V and 200mA minimum can be used. Please contact JLM Innovation for options!

Analog Inputs

In single ended mode 2 analog signals may be connect to the ZNet node via connector X1. Input range of the analog signals is 0 to 2.56V against common ground. The resolution is 10 bit.

In differential mode one analog signal may be measured. Connect the positive input to channel 1 and the negative input to channel 2. Native resolution is 10 bit. A gain stage allows amplifying the input by 1, 10, or 200. If gains of 1 or 10 are used the effective resolution is 8 bit. At a gain of 200 the effective resolution is decreased to 6 bit.

Digital Inputs

Digital signals with TTL levels of 3.3V may be connected via connector X1. Various interfaces are possible (UART, SPI, I2C). This allows to connect high resolution AD converters or integrated digital sensors. However, firmware adaptations are required to operate any serial interface. Please contact JLM Innovation with your requirements.

Connector X1

Additional sensors may be connected via connector X1. Additionally the firmware of the micro controller may be updated via this connector. Depending on the firmware version a UART-interface on the connector may be used to connect to sub systems or may be used for debugging purposes.

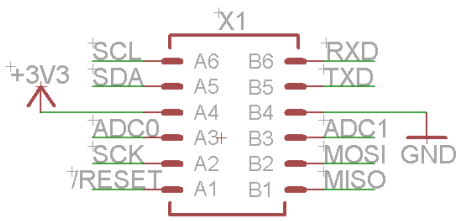

Figure 2: Connector X1

Connector X1 is shown in figure 2. The orientation is equal to the orientation of the connector in figure 1, i.e. pin B6 is in the upper right end of the PCB.

Description of the pins:

A1 /RESET Reset Input of the micro controller

SPI connections:

A2 SCK Clock of the SPI interface

B1 MISO MISO of the SPI inteface

B2 MOSI MOSI of the SPI interface

Analog inputs:

A3 ADC0 A/D channel 1 or A/D positive input or digital IO (depending on firmware)

B3 ADC1 A/D channel 2 or A/D negative input or digital IO (depending on firmware)

Power supply:

A4 +3V3 3.3V output (max 50mA may be provided)

B4 GND common ground

I2C-Bus:

A5 SDA I2C data

A6 SCL I2C clock

UART interface:

B5 TXD TXD of the UART (3.3V TTL)

B6 RXD RXD of the UART (3.3V TTL)

Set-up of the Network

During initial operation of the network the first step is to install the USB-Stick on the PC. Subsequently the ZNet Server program is started. Then the batteries are inserted into the sensor nodes.

Installation of the USB-Stick:

Please install the drivers for the USB-Stick by running the program PreInstaller before connecting the Stick to the PC.

Connect the USB-Stick to the PC. A COM-Port will be assigned to the USB-Stick. Please note that COM-Port. You may check the assigned COM-Port by opening the device manager of Windows. The Com-Port will be shown under Connections (COM&LPT) as long as the USB-Stick is connected to the PC.

Installation of the ZNetServer Software:

The program ZNetServer does not require specific installation. Please copy the program to a folder of your choice and execute the program via double click.

Subsequently the COM-Port of the USB-Stick needs to be selected. The baud rate should be set to 19200.

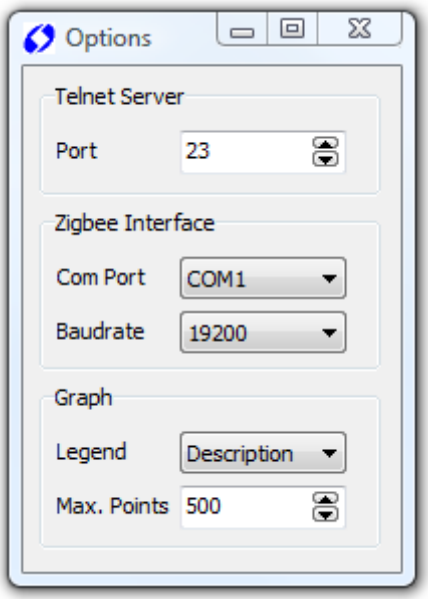

Figure 3: Options of ZNetServer

The Telnet Server Port is the Ethernet Port that may be used by other programs to connect to the ZNetServer.

Legend and Max.Points set display options for the graphs in ZNetServer.

Initial Operation of the Sensor Nodes:

Please insert the batteries into the sensor nodes now.

After a few minutes the sensor nodes should have automatically connected to the sensor network.

By pressing the button “Scan” all nodes connected to the network will be shown in ZNetServer. For each sensor node a message in the form of FFD<EUI64-Adresse> should show up in the message area.

Now the sensor nodes have to be added to the list “Sensor Nodes”. Please click on the “Add” button. (This has to be done for every sensor node in the network). Following dialog will open:

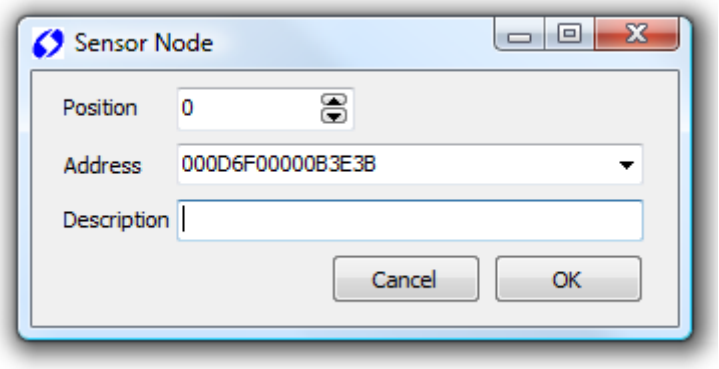

Figure 4: Settings for a sensor node.

Please set the EUI64-Address, that is printed on the wireless transceiver of the sensor node. The EUI64-Addresses can be selected by clicking on the small arrow in the field “Address”.

The Fields “Position” and “Description” may be set-up to any values. “Position” is used to identify sensor nodes in the log file and in transmissions to subsequent programs. “Description” can be used to enter any text that describes the sensor node (e.g. placement of the sensor node).

Button “Del” will delete any selected sensor nodes in the list. Button “Edit” can be used to change above settings for a sensor node.

Configuring Sensor Nodes as End Device or Router

An end device is asleep most of the time and only wakes up to send new measurement data, or to check for new messages. This provides for long battery operation of up to 2 years depending on the acquisition rate.

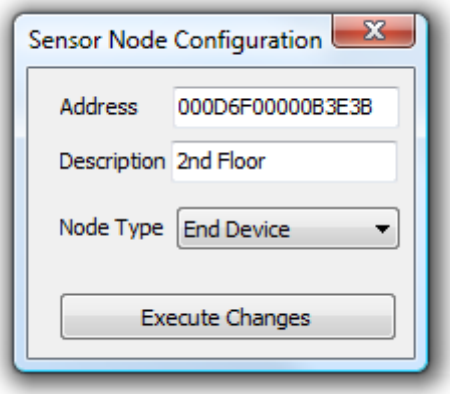

Figure 5: Configuring a sensor node as end device.

A router is awake all the time and may relay messages from other nodes in order to extend the range of wireless network. The power consumption of a router is therefore considerably higher. Routers will normally be operated by a power supply.

To change the mode of a sensor node select the node in the list and click on the “Config”. The “Sensor Node Configuration” dialog will open (see figure 5). Select the Node Type and press “Execute changes”. Configuring a node will take about half a minute.

Using the ZNetServer Program in Normal Operation

After options and sensor nodes have been correctly configured, a measurement can be started and stopped by clicking on the buttons “Start” and “Stop”.

The field “Interval” allows to set the acquisition rate in seconds .

A log file may be selected by clicking into the field “Log File”. If the selected file exists, new measurement data will be appended to the end of the file.

The buttons „Sensors“, Buzzer“, „LED3 On“ und „LED3 Off“ send commands those nodes, that are selected in the „Sensor Nodes“ List:

„Sensors“: perform a single acquisition of all sensors.

„Buzzer“: play a short melody (connect a buzzer to JP2!).

„LED3 On“: switch on LED3

„LED3 Off“: switch off LED3

The lower left area is a text area that shows messages from the sensor nodes and any connect clients.

The list “Clients” nest to the “Sensor Nodes” list shows and client programs that are connected to the SNetServer via telnet.

The right side of the window diplays graphs for each sensor type. Within each graph the measurement data received from all connected sensor nodes is shown.

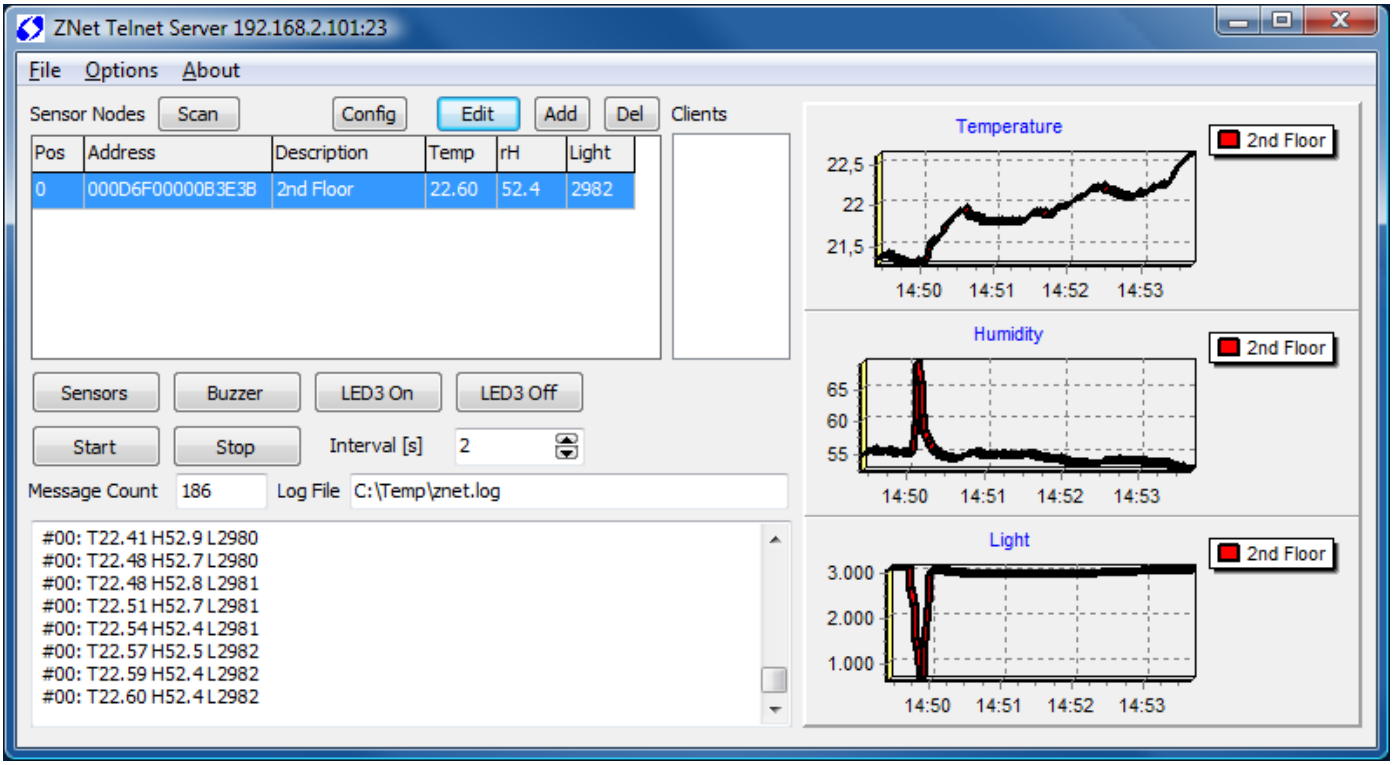

Figure65: ZNetServer program